

inline

vortex

flowmeter

Model Vortex PhD™ General Specification

Features

- ▶ **Reliable**—no moving parts, no fluid to sensor contact
- ▶ **In-process removable sensor**, below 750 psig (52 barg) pressure
- ▶ **Simple, rugged, all welded construction**, no internal gaskets, no leak paths
- ▶ **High accuracy with wide rangeability**
- ▶ **Line sizes from 1" to 12"** (25–300mm)
- ▶ **High temperature operation up to 750°F (400°C)**
- ▶ **EZ Logic™ menu-driven user interface**
- ▶ **'Smart' electronics provide excellent noise immunity**
- ▶ **Compatible with HART Protocol**
- ▶ **Optional Dual sensors and transmitters for fail-safe monitoring**



The EMCO Vortex PhD vortex shedding flowmeter measures process fluid flow by detecting the frequency at which vortices are shed from an obstruction in the process fluid line (the bluff body). A piezo-electric sensor mounted outside the flow line acts as the transducer, converting vortex pulses into electrical signals.

The 'Smart' electronics provide excellent noise immunity while the wide range of wetted materials provide outstanding compatibility with most process fluids. The transmitter provides a frequency output, scaled frequency output, totalizer pulse or a 4-20 mA DC signal proportional to the flow rate.

Performance Specifications

Accuracy

Liquid ±0.7% of flow rate
 Gas and Steam ±1.0% of flow rate
 Analog Output Version ... Add ±0.1% of full scale

Repeatability

±0.15% of flow rate

Response Time

Adjustable from 1–100 seconds (analog version output)

K-factor–Temperature Correction

The K-factor of the flowmeter decreases by 0.29% for each 100°F (39°C) increase in temperature above 70°F (21°C). The converse is true below 70°F (21°C). By programming the operating fluid temperature in the electronics, the change in the K-Factor is automatically corrected for.

Operating Specifications

Fluid Types

Liquid, gas or steam

Line Sizes

1"–12" (25mm to 300mm)

Process Temperature Limit

–40 to 750°F (–40 to 400°C)

Process Pressure

Flange

ANSI Class 150, 300 or 600, PN16, 40, 64

Wafer

All wafer bodies are rated based on appropriate flange rating to a maximum of ANSI Class 600

Enclosure Specifications

Approved for NEMA 4X watertight and dust tight requirements.

Ambient Temperature Limit

Normal

–20 to 140°F (–29 to 60°C)

Display Option

32–140°F (0–60°C)

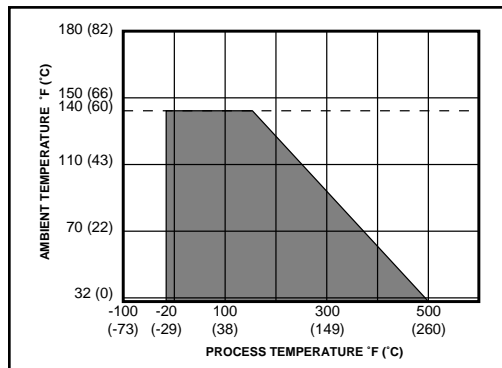


Figure 1. Ambient Temperature Range for Locally Mounted Electronics.

Ambient Humidity Limit

5–100% RH non-condensing

Power Requirements

18–40 VDC; max power consumed: 1 watt

Output

Analog

4–20 mA, loop powered 2 wire system, digitally adjusted span

Frequency

Voltage pulses, 3 wire system, 1 to 10 kHz square wave, open collector FET output with selectable pull-up resistors. The pulse output can be scaled so that 1 pulse represents a specific quantity of fluid passing through the flowmeter. For typical applications, the amplitude of the squarewave can be determined by:

$$V_{\text{pulse}} = V_s - (I \cdot R_{\text{load}})$$

For other options refer to the Vortex PhD manual

Span Setting

For analog outputs the span setting can be adjusted without the use of electronic test equipment by programming the full scale rate using the EZ Logic™ keypad.

HART Protocol

In addition to using the keypad for field configuration, the Vortex PhD is also compatible with a laptop PC using a Hart Modem and EMCO EZ Comm communications software. This can be used to calibrate the 4-20 ma settings, set the 20 mA point, assign a tag or descriptor, display flowrate, output level, total, velocity and shedding frequency.

Cable Conduit Connection

ANSI 3/4" female NPT. See Dimensions. (p. 9)

DIN PG 13.5. See Dimensions. (p. 9)

Signal Cable

18, 20 or 22 gauge, shielded instrumentation cable. Belden #9939 double shielded cable or equivalent required for European CE rating.

Measurable Flow Velocities

Liquid

1.5 to 32 ft/sec (0.5 to 9m/sec)

Gas/Steam $\sqrt{\frac{50}{\rho}}$ to 260 ft/sec $\left(\sqrt{\frac{74}{\rho}} \text{ to } 79 \text{ m/sec} \right)$

Where:

ρ = density in $\frac{\text{lb}}{\text{ft}^3}$ $\left(\frac{\text{kg}}{\text{m}^3} \right)$

Process Viscosity

Reynolds number must be >: 20,000 (See Figure 3)

Linear Range

Reynolds Numbers of 20,000 to 7,000,000

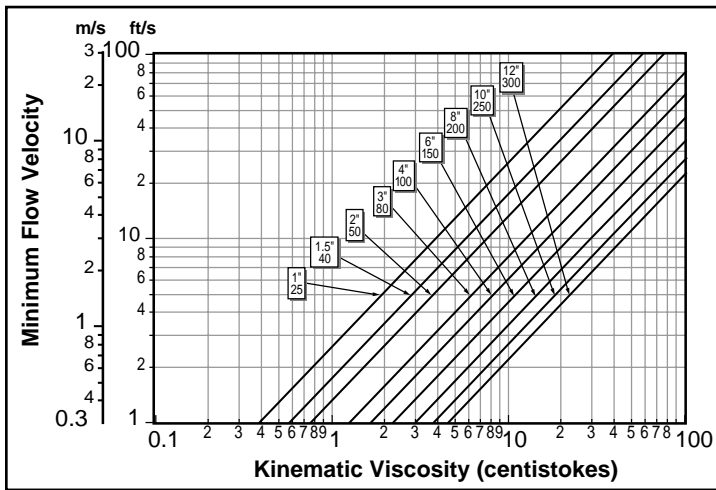


Figure 3. Minimum Linear Flow Velocity vs. Kinematic Viscosity.

NOMINAL SIZE		NOMINAL PULSE RATE		NOMINAL METER FACTOR			
inch	mm	Hz/ft/s	Hz/m/s	pulses/gal	pulses/L	pulses/ft ³	pulses/m ³
1	25	12.0	39.4	321.2	84.9	2,403	84,864
1.5	38	7.5	24.6	81.7	21.6	611	21,578
2	50	6.0	19.7	39.1	10.3	293	10,349
3	80	4.0	13.1	11.7	3.1	87.2	3,080
4	100	3.0	13.1	11.7	3.1	87.2	3,080
6	150	2.0	6.6	1.5	0.4	11.0	388
8	200	1.3	4.3	0.6	0.2	4.2	148
10	250	1.2	3.9	0.3	0.1	2.2	78
12	300	1.0	3.3	0.2	0.1	1.3	46

Table 1. Nominal Pulse Rate and Flowmeter Factor.

NOMINAL SIZE		FLOW RANGE in GPM		FLOW RANGE in L/s	
inch	mm	min	max	min	max
1	25	3.4	72	0.2	4.5
1.5	40	8.3	176	0.5	11.1
2	50	13.8	295	0.9	18.6
3	80	30.9	659	1.9	41.6
4	100	53.8	1,147	3.4	72.3
6	150	121.9	2,600	7.7	163.9
8	200	213.5	4,555	13.5	287.2
10	250	358.7	7,653	22.6	482.5
12	300	508.3	10,843	32.0	683.7

Table 2. Water Flow Rates.

Notes:

- Water values are determined at standard conditions of 60°F (15°C).
- The minimum flow rate for the 1" (25 mm), and 1.5" (40 mm) flowmeters are below the linear range—the Reynolds number < 20,000).
- The velocities used to calculate the minimum and maximum flow rates were 1.5 ft/sec and 32 ft/sec (0.5 m/sec and 9 m/sec) respectively.

For EMCO Flowmeter Sizing Download [emcosizing program "emcosize"](#) at www.emcoflow.com

Flowmeter Sizing

Selecting the appropriate size flowmeter can be critical. If the flowmeter is over-sized, the signal strength could be weak—limiting rangeability. If the flowmeter is undersized, excessive pressure drop or cavitation may occur—affecting accuracy. Use the minimum linear flow velocity curves and Tables 2 through 8 (minimum and maximum flow rates for various types of applications) for general sizing. For more detailed information, contact your EMCO representative or go to www.emcoflow.com for EMCO computerized sizing program.

Pressure Loss

If a differential pressure transducer were connected between pressure taps up and downstream of a vortex flowmeter, the measured differential pressure would be the pressure loss for the device. This value can be calculated using the following equations:

English $\Delta P = 2.67 \times 10^{-4} \cdot \rho \cdot V^2$
 or $\Delta P = 2.50 \times 10^{-3} \cdot \rho \cdot (Q_1)^2 / D^4$
 or $\Delta P = 4.47 \times 10^{-5} \cdot \rho \cdot (Q_2)^2 / D^4$
 Metric $\Delta P = 1.24 \times 10^{-5} \cdot \rho \cdot V^2$
 or $\Delta P = 5572 \cdot \rho \cdot (Q_1)^2 / D^4$
 or $\Delta P = 20.1 \cdot \rho \cdot (Q_2)^2 / D^4$

Where:

- ΔP = Pressure loss psi (bar)
- ρ = Density at operating conditions lb/ft³ (kg/m³)
- V = Flow velocity in ft/s (m/s)
- Q_1 = Volumetric flow rate in ACFM (Actual m³/min)
- Q_2 = Volumetric flow rate in U.S. GPM (L/s)
- D = Flowmeter internal diameter in inches (mm)

Minimum Back Pressure (Liquid Service Only)

The line pressure must be sufficiently high so that no cavitation occurs. The minimum required line pressure can be obtained from the equation:

$$P_G \geq (1 \cdot 3 \cdot P_o) + (2.7 \cdot \Delta P) - P_{ATM}$$

Where:

- P_G = Line pressure required psig (barg)
- ΔP = Maximum pressure loss psig (barg)
- P_o = Saturation liquid vapor pressure at operating temperature psia (bara)
- P_{ATM} = Atmospheric pressure psia (bara)

Example:

Water flow rate: 0 to 200 US GPM
 Operating temperature: 100 °F
 Operating pressure: 10 psig
 Atmospheric pressure: 14.7 psia
 Flowmeter size: 1.939" I.D.
 Specific weight: 61.96 lb/ft³

Solution:

$$\Delta P = 4.47 \times 10^{-5} \cdot 61.96 \cdot (200)^2 / (1.939)^4 = 7.84$$

$$P_G = [(1.3) \cdot (0.951)] + [(2.7) \cdot (7.84)] - 14.7$$

$$P_G = 7.70 \text{ psig}$$

Since the operating pressure of 10 psig is higher than 7.70 psig, no cavitation occurs.

Physical Specifications

Materials

Wetted Parts

Wing and Shedder Bar

- Stainless steel and Carbon steel Models
316L or the cast equivalent, CF3M

- Hastelloy Model
Hastelloy Alloy C-22

Body

- Stainless steel Model (all sizes)
316L or the cast equivalent, CF3M
- Hastelloy Model 1" thru 4" (25mm thru 100mm)
Hastelloy Alloy C-22
- Carbon Steel Model (flanged),
6" (150mm) and larger
ASTM A105, A06 Grade C, and A108 Grade
1018

Electronics Enclosure

383 Aluminum

All Other Parts

Stainless Steel

Flowmeter Classification

Standard

Designed to meet NEMA 4X watertight and dust tight specifications

Explosion Proof version

FM and CSA approved

Explosion Proof and Intrinsically-Safe version

CENELEC approved

European CE Mark

Approved

Remote Mount Electronics (RMT)

Signal cable is provided to mount the electronics enclosure up to 30 ft (optional 50 ft) from the flowmeter body, and must be installed within proper electrical conduit.

Local Indicator and Totalizer (LOC-TOT)

The indicator displays flowrate and total in user-selectable, engineering units. It is a two line, 8 character per line, LCD display. The totalizer enables a pulse output providing a 5–999 msec pulse each time the totalizer increments.

Note: This option changes the lower, ambient temperature limit to 32°F (0°C). Below 32°F, the display intensity begins to fade but does not affect the transmitter output.

Material of Construction

All models are available in stainless steel; some models can be ordered in Hastelloy C-22 or carbon steel.

FM Approval (Explosion Proof)

Class I, Div. I, Groups B, C, D

Class II, Div. I, Groups E, F, G

Class I, Div. II, Groups A, B, C, D

Class II, III, Div. 2, Groups F, G

CSA Approval (Explosion Proof)

Class I, Div. I, Groups B, C, D

Dust-ignition Proof for Class II, Div. 1 Groups E, F, G

Class III Hazardous locations

CENELEC Approval

(Explosion Proof and Intrinsically Safe)

EEX d [ib] IIC T6 and/or EEX d IIC T6.

Accessories

Flow Rectifier (EFR)

When there is not sufficient straight run of pipe available or flow disturbance exists, use of a flow rectifier is recommended. When using an EFR, the straight pipe run can be a combination of 5 pipe diameters upstream and 2 pipe diameters downstream, instead of the standard 10 and 5.

Flow Processor

A microprocessor-based flow processor can be used to significantly increase the accuracy and functionality of any flowmetering application. See the FP-93 or FP-100 General Specifications for complete details.

Straight Run Piping Requirements

Typical 10 diameters upstream, 5 diameters downstream. In certain applications where multiple bends or butterfly valves are present, more straight run may be required.

	Upstream	Downstream
One 90° elbow before the meter	10 D	5 D
Two 90° elbows before the meter	15 D	5 D
Two 90° elbows out of plane before the meter	30 D	5 D
Reduction before the meter	10 D	5 D
Regulator or valve partially closed before the meter	30 D	5 D

Other Installation Considerations

Installation

Flowmeter can be installed vertically, horizontally, or at any angle. For liquid service, the flow line must be full during flowmeter operation—flow up in vertical lines is recommended.

Site Selection

The flow measurement location should be selected to minimize turbulence and swirl. The extent of these flow disturbances depends upon the piping configuration. Valves, elbows, pumps and other piping components may add disturbances to the flow.

Servicability

The sensor element can be removed, and replaced, without removing the flowmeter body from the process line, and without process shut down—for process pressures below 750 psig (52 bar). The flowmeter K-factor is not affected by sensor or electronics servicing. The Dual option allows service of one sensor and electronics while the other transmitter provides continuous flow measurement.

Pressure and Temperature Taps

Pressure tap should be mounted 3.5 to 7 pipe diameters downstream from the flowmeter. The temperature tap should be mounted an additional 3.5 to 7 pipe diameters downstream of the pressure tap. See Figure 2.

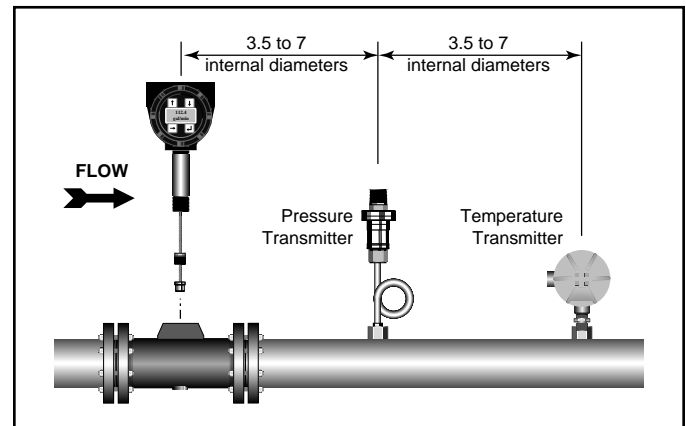


Figure 2. Pressure and Temperature Tap Dimensions.

Pres PSIG	1"		1.5"		2"		3"		4"		6"		8"		10"		12"	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
10	31	283	77	697	129	1164	288	2604	501	4534	1135	10277	1988	18000	3341	30258	4733	42860
15	34	337	84	828	140	1383	313	3094	546	5387	1237	12213	2167	21390	3642	35955	5160	50930
20	37	390	90	958	151	1600	337	3580	587	6233	1331	14129	2331	24746	3918	41597	5550	58923
30	41	494	102	1214	170	2029	380	4539	661	7903	1498	17915	2624	31377	4412	52742	6249	74710
40	45	597	112	1468	187	2453	417	5486	727	9552	1647	21655	2885	37927	4850	63753	6870	90307
50	49	699	121	1719	202	2872	452	6424	786	11186	1783	25357	3122	44412	5249	74654	7435	105748
60	53	801	129	1968	216	3289	483	7356	841	12807	1908	29033	3341	50849	5616	85474	7955	121075
70	56	901	137	2215	229	3702	513	8281	893	14419	2024	32686	3545	57248	5959	96231	8441	136312
80	59	1002	145	2462	242	4114	541	9202	941	16022	2134	36321	3737	63614	6282	106932	8898	151470
90	62	1102	152	2707	253	4524	567	10120	987	17619	2237	39942	3919	69956	6587	117593	9331	166572
100	64	1201	158	2952	265	4933	592	11034	1031	19211	2336	43550	4092	76275	6878	128214	9743	181617
120	70	1399	171	3439	286	5747	639	12855	1112	22382	2522	50740	4417	88868	7424	149382	10517	195065
140	74	1597	183	3925	305	6559	683	14670	1188	25543	2694	57904	4718	101416	7931	166214	11235	197804
160	79	1794	194	4409	323	7369	723	16482	1260	28697	2855	65054	5001	113938	8407	168295	11908	200281
180	83	1991	204	4893	341	8177	762	18291	1327	31846	3008	72193	5268	126441	8856	170158	12545	202498
200	87	2188	214	5377	357	8986	799	20099	1391	34994	3153	79330	5523	132583	9283	171911	13150	204584
220	91	2385	223	5861	373	9795	834	21908	1452	38143	3292	86469	5766	133935	9692	173654	13729	206670
250	96	2680	237	6588	395	11009	884	24624	1540	42873	3490	97191	6113	135625	10275	175855	14555	209278
300	105	3175	257	7803	430	13040	962	29166	1676	50781	3798	104535	6653	138329	11183	179362	15841	213450
350	113	3672	277	9025	463	15082	1035	33734	1802	58735	4085	106259	7155	140610	12027	182320	17036	216971
400	120	4173	295	10256	493	17140	1103	38337	1921	66748	4355	107855	7627	142723	12821	185059	18161	220231
450	127	4679	313	11498	522	19215	1168	42978	2034	72657	4611	109388	8076	144751	13575	187689	19229	223360
500	134	5189	329	12751	550	21310	1230	47665	2142	73548	4856	110729	8505	146525	14296	189990	20251	226098
600	147	6225	361	15299	602	25568	1348	57016	2346	75244	5523	117628	9316	149906	15659	194372	22182	231314

Table 3. Saturated Steam Flow Rates at Selected Process Pressures (English):^{1,2}
 (Minimum and Maximum Operating Flow Rates in lb/hr)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

Pres BARG	25mm		40mm		50mm		80mm		100mm		150mm		200mm		250mm		300mm	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0.7	14	129	35	316	58	528	130	1181	227	2056	515	4662	902	8165	1516	13725	2147	19441
1.0	15	153	38	375	64	627	142	1403	248	2444	561	5540	983	9702	1652	16309	2340	23102
1.4	17	177	41	434	68	726	153	1624	266	2827	604	6409	1057	11225	1777	18868	2517	26727
2.1	19	224	46	551	77	920	172	2059	300	3585	680	8126	1190	14232	2001	23924	2835	33888
2.8	21	271	51	666	85	1113	189	2489	330	4333	747	9822	1309	17203	2200	28918	3116	40962
3.4	22	317	55	780	92	1303	205	2914	357	5074	809	11502	1416	20145	2381	33862	3372	47966
4.1	24	363	59	893	98	1492	219	3336	382	5809	865	13169	1515	23065	2547	38771	3608	54919
4.8	25	409	62	1005	104	1679	233	3756	405	6540	918	14826	1608	25967	2703	43649	3829	61830
5.5	27	454	66	1117	110	1866	245	4174	427	7267	968	16475	1695	28855	2849	48503	4036	68706
6.2	28	500	69	1228	115	2052	257	4590	448	7992	1015	18117	1778	31732	2988	53339	4232	75556
6.9	29	545	72	1339	120	2238	268	5005	467	8714	1060	19754	1856	34598	3120	58157	4419	82380
8.3	32	635	78	1560	130	2607	290	5831	505	10152	1144	23015	2003	40310	3368	67759	4770	88480
9.7	34	724	83	1780	138	2975	310	6654	539	11586	1222	26265	2140	46002	3598	75393	5096	89722
11.0	36	814	88	2000	147	3342	328	7476	571	13017	1295	29508	2268	51681	3813	76337	5401	90846
12.4	38	903	92	2220	155	3709	346	8296	602	14445	1364	32746	2390	57353	4017	77182	5690	91851
13.8	39	992	97	2439	162	4076	362	9117	631	15873	1430	35984	2505	60139	4211	77978	5965	92798
15.2	41	1082	101	2658	169	4443	378	9937	659	17302	1493	39222	2615	60752	4396	78773	6227	93744
17.2	44	1216	107	2988	179	4994	401	11169	698	19447	1583	44085	2773	61518	4661	79767	6602	94927
20.7	48	1440	117	3539	195	5915	437	13229	760	23034	1723	47416	3018	62745	5073	81357	7185	96820
24.1	51	1666	126	4094	210	6841	469	15302	817	26642	1853	48198	3245	63780	5455	82699	7728	98416
27.6	54	1893	134	4652	224	7774	500	17389	871	30276	1975	48922	3460	64738	5816	83941	8238	99895
31.0	58	2122	142	5215	237	8716	530	19495	923	32957	2092	49617	3663	65658	6158	85134	8722	101314
34.5	61	2354	149	5784	249	9666	558	21620	972	33361	2203	50226	3858	66463	6485	86178	9186	102557
41.4	67	2824	164	6940	273	11597	611	25862	1064	34130	2505	53355	4226	67996	7103	88166	10061	104922

Table 4. Saturated Steam Flow Rates at Selected Process Pressures (Metric):^{1,2}
 (Minimum and Maximum Operating Flow Rates in kg/hr)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

Notes:

- Maximum flow velocity is 260 ft/sec (79 m/s) or Reynolds number limit or 7,000,000 whichever is less.
- Minimum flow velocity is $\sqrt{\frac{50}{\rho}}$ ft/sec, where ρ = density in $\frac{\text{lb}}{\text{ft}^3}$ ($\sqrt{\frac{74}{\rho}}$ m/sec, where ρ = density in $\frac{\text{kg}}{\text{m}^3}$) or Reynolds number limit of 20,000 whichever is greater.

Pres PSIG	1"		1.5"		2"		3"		4"		6"		8"		10"		12"	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0	711	4675	1130	11486	1888	19194	4224	42934	7352	74730	16669	169433	29201	296813	49087	498888	69532	706680
10	711	7858	1465	19306	2448	32260	5476	72160	9531	125601	21611	284772	37857	498864	63722	838268	90263	1187415
20	711	11043	1737	27129	2902	45332	6491	101403	11299	176499	25618	400174	44877	701024	75490	1177647	106933	1668149
30	802	14229	1971	34957	3294	58412	7369	130661	12826	227425	29080	515637	50942	903292	85473	1517027	121073	2148884
40	888	17417	2181	42789	3645	71499	8152	159934	14190	278378	32173	631161	56360	1105667	94572	1856406	133962	2629619
50	966	20606	2372	50624	3964	84593	8868	189223	15435	329357	34995	746746	61304	1308148	102870	2195786	145716	3065336
60	1038	23798	2550	58464	4260	97693	9529	218527	16587	380363	37607	862390	65880	1510734	110546	2535166	156590	3066018
70	1105	26990	2715	66308	4537	110800	10149	247845	17665	431394	40050	978094	70160	1713422	117723	2576801	166756	3066539
80	1169	30185	2871	74156	4798	123914	10732	277179	18681	482452	42354	1093855	74196	1916212	124487	2577147	176337	3066950
90	1229	33381	3020	82008	5046	137034	11286	306527	19645	533534	44540	1209674	78025	1981748	130782	2572706	185254	3061665
100	1287	36578	3161	89863	5282	150160	11814	335889	20564	584642	46625	1325549	81677	1981748	136902	2573347	193923	3062428
120	1395	42978	3426	105586	5725	176433	12806	394656	22291	686931	50539	1497292	88534	1981748	148387	2574344	210192	3063615
140	1495	49384	3673	121323	6137	202729	13728	453478	23894	789315	54175	1497292	94903	1981748	158946	2571893	225149	3060698
160	1589	55795	3904	137075	6523	229050	14592	512354	25398	891794	57584	1497292	100876	1981748	168847	2570006	239173	3058452
180	1678	62213	4122	152840	6888	255394	15408	571282	26819	994362	60805	1497292	106519	1981748	177936	2560955	252048	3047681
200	1762	68635	4330	168619	7235	281760	16184	630260	28169	994383	63867	1497292	111882	1981748	187249	2571876	265241	3060678
220	1843	75063	4528	184411	7566	308148	16925	689287	29459	994383	66791	1497292	117004	1981748	195325	2560024	276680	3060678
250	1958	84715	4810	208123	8038	347770	17980	753714	31295	994383	70955	1497292	124299	1981748	207975	2573422	294599	3062517
300	2136	100825	5248	247701	8769	413905	19615	753714	34141	994383	77408	1497292	135604	1981748	226127	2558874	320311	3045204
350	2301	116963	5652	287347	9445	480154	21127	753714	36772	994383	83373	1497292	146053	1981748	243566	2561760	345014	3048639
400	2454	133125	6030	327054	10076	503949	22539	753714	39231	994383	88947	1497292	155818	1981748	259241	2552194	367217	3037255
450	2599	149310	6386	366814	10671	503949	23870	753714	41547	994383	94199	1497292	165018	1981748	274584	2555165	388951	3040791
500	2737	165512	6724	389852	11235	503949	25132	753714	43743	994383	99179	1497292	173741	1981748	288580	2548126	408777	3032414
600	2993	197961	7353	389852	12287	503949	27485	753714	47840	994383	108466	1497292	190010	1981748	315201	2545390	446486	3029158

Table 5. Air Flow Rate at Selected Process Pressures (Metric)^{1,2,3}
(Minimum and Maximum Operating Flow Rates in SCFH)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

PresBARG	25mm		40mm		50mm		80mm		100mm		150mm		200mm		250mm		300mm	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0.0	19	125	30	308	51	514	113	1150	197	2002	446	4538	782	7950	1313	13344	1860	18902
0.7	19	210	39	517	66	864	147	1933	255	3364	579	7627	1014	13362	1705	22426	2415	31767
1.4	19	296	47	727	78	1214	174	2716	303	4727	686	10718	1202	18776	2020	31508	2861	44632
2.1	21	381	53	936	88	1565	197	3500	344	6091	779	13811	1364	24194	2287	40591	3240	57497
2.8	24	466	58	1146	98	1915	218	4284	380	7456	862	16905	1510	29614	2531	49673	3584	70362
3.4	26	552	64	1356	106	2266	238	5068	413	8822	937	20001	1642	35038	2753	58755	3899	82023
4.1	28	637	68	1566	114	2617	255	5853	444	10188	1007	23098	1765	40464	2958	67837	4190	82042
4.8	30	723	73	1776	122	2968	272	6638	473	11555	1073	26197	1879	45892	3150	68952	4462	82057
5.5	31	808	77	1986	129	3319	287	7424	500	12922	1134	29298	1987	51324	3331	68962	4719	82069
6.2	33	894	81	2197	135	3670	302	8210	526	14290	1193	32400	2090	53079	3500	68844	4957	81928
6.9	34	980	85	2407	141	4022	316	8996	551	15659	1249	35504	2188	53079	3663	68861	5189	81949
8.3	37	1151	92	2828	153	4726	343	10571	597	18399	1354	40104	2371	53079	3971	68889	5625	81982
9.7	40	1323	98	3250	164	5430	368	12146	640	21141	1451	40104	2542	53079	4253	68824	6025	81904
11.0	43	1494	105	3671	175	6135	391	13723	680	23886	1542	40104	2702	53079	4518	68774	6400	81845
12.4	45	1666	110	4094	184	6840	413	15301	718	26633	1629	40104	2853	53079	4762	68532	6745	81557
13.8	47	1838	116	4516	194	7547	433	16881	754	26634	1711	40104	2997	53079	5011	68824	7098	81905
15.2	49	2011	121	4939	203	8253	453	18462	789	26634	1789	40104	3134	53079	5227	68507	7404	81528
17.2	52	2269	129	5574	215	9315	482	20188	838	26634	1900	40104	3329	53079	5566	68866	7884	81954
20.7	57	2701	141	6634	235	11086	525	20188	914	26634	2073	40104	3632	53079	6051	68477	8572	81492
24.1	62	3133	151	7696	253	12860	566	20188	985	26634	2233	40104	3912	53079	6518	68555	9233	81584
27.6	66	3566	162	8760	270	13498	604	20188	1051	26634	2382	40104	4173	53079	6937	68299	9827	81279
31.0	70	3999	171	9825	286	13498	639	20188	1113	26634	2523	40104	4420	53079	7348	68378	10409	81374
34.5	73	4433	180	10442	301	13498	673	20188	1172	26634	2656	40104	4653	53079	7723	68190	10939	81150
41.4	80	5302	197	10442	329	13498	736	20188	1281	26634	2905	40104	5089	53079	8435	68117	11948	81063

Table 6. Air Flow Rate at Selected Process Pressures (Metric)^{1,2,3}
(Minimum and Maximum Operating Flow Rates in NCMH)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

Notes:

- At standard conditions of 60°F and 14.7 psia, SCFH: standard cubic feet per hour (0°C and 1.013 bar, NCMH: Normal cubic meters per hour). Process temperature is 60°F (16°C).
- Maximum flow velocity is 260 ft/sec (79 m/s) or Reynolds number limit or 7,000,000 whichever is less.
- Minimum flow velocity is $\sqrt{\frac{50}{\rho}}$ ft/sec, where ρ = density in $\frac{\text{lb}}{\text{ft}^3}$ ($\sqrt{\frac{74}{\rho}}$ m/sec, where ρ = density in $\frac{\text{kg}}{\text{m}^3}$) or Reynolds number limit of 20,000 whichever is greater.

Pres PSIG	1"		1.5"		2"		3"		4"		6"		8"		10"		12"	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0	772	4665	1444	11460	2413	19149	5397	42834	9395	74557	21300	169041	37314	296126	64968	511367	93181	733432
10	772	7851	1873	19289	3130	32231	7002	72096	12188	125490	27634	284520	48410	498422	84286	860683	120888	123441
20	905	11048	2222	27142	3713	45354	8307	101452	14458	176585	32781	400368	57426	701364	99983	1211101	143401	1737031
30	1028	14255	2524	35021	4218	58520	9436	130901	16423	227844	37236	516588	65230	904957	113570	1562626	162889	2241207
40	1138	17472	2795	42925	4670	71728	10446	160445	18182	279268	41225	633180	72217	1109202	125733	1915261	180334	2746978
50	1238	20700	3042	50855	5083	84978	11370	190084	19791	330857	44871	750146	78605	1314104	136853	2269014	196283	2746978
60	1332	23938	3271	58810	5466	98271	12227	219818	21282	382611	48253	867489	84530	1519664	147166	2623888	211075	3254350
70	1419	27187	3486	66791	5825	111606	13030	249648	22680	434533	51423	985209	90083	1725887	156833	2890521	224938	3461702
80	1502	30446	3689	74797	6165	124985	13789	279575	24001	486622	54418	1103309	95329	1932775	165965	2890521	238036	3461702
90	1580	33715	3882	82829	6487	138407	14511	309597	25257	538879	57265	1221791	100317	2140331	174647	2890521	250488	3461702
100	1655	36995	4067	90887	6795	151872	15200	339717	26457	591305	59966	1340656	105084	2152958	182943	2890521	262387	3461702
120	1797	43587	4414	107082	7376	178933	16499	400250	28718	696667	65112	1579542	114062	2152958	198569	2890521	284500	3461702
140	1929	50222	4738	123382	7917	206171	17710	461176	30826	802714	69892	1626648	122436	2152958	213142	2890521	305701	3461702
160	2053	56900	5043	139789	8427	233585	18851	522500	32812	909452	74394	1626648	130323	2152958	226866	2890521	325384	3461702
180	2171	63622	5333	156302	8911	261179	19933	584223	34696	1016887	78665	1626648	137805	2152958	239886	2890521	344058	3461702
200	2283	70388	5609	172924	9373	288953	20967	646350	36494	1080291	82742	1626648	144947	2152958	252312	2890521	361881	3461702
220	2391	77198	5874	189654	9816	316909	21957	708885	38219	1080291	86652	1626648	151797	2152958	264230	2890521	378973	3461702
250	2546	87496	6254	214956	10450	359188	23376	803456	40688	1080291	92252	1626648	161606	2152958	281293	2890521	403446	3461702
300	2787	104888	6847	257682	11442	430583	25594	818830	44549	1080291	101005	1626648	176940	2152958	307963	2890521	441698	3461702
350	3013	122567	7402	301115	12369	503159	27667	818830	48157	1080291	109186	1626648	191271	2152958	332885	2890521	477442	3461702
400	3226	140539	7926	345267	13245	547487	29626	818830	51567	1080291	116917	1626648	204815	2152958	356431	2890521	511214	3461702
450	3430	158808	8426	390150	14079	547487	31493	818830	54816	1080291	124284	1626648	217720	2152958	378865	2890521	543389	3461702
500	3625	177379	8905	423533	14880	547487	33284	818830	57933	1080291	131350	1626648	230098	2152958	400376	2890521	574242	3461702
600	3995	215439	9814	423533	16398	547487	36681	818830	63846	1080291	144757	1626648	253585	2152958	441178	2890521	632763	3461702

Table 7. Natural Gas Flow Rates at Selected Process Pressures (English)^{1,2,3,4}
(Minimum and Maximum Operating Flow Rates in SCFH)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

PresBARG	25mm		40mm		50mm		80mm		100mm		150mm		200mm		250mm		300mm	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0.0	21	125	39	307	65	513	145	1147	252	1997	571	4528	999	7931	1743	13711	2500	19655
0.7	21	210	50	517	84	863	188	1931	326	3361	740	7621	1297	13350	2269	23220	3254	33303
1.4	24	296	60	727	99	1215	222	2717	387	4730	878	10724	1538	18785	2695	32759	3865	46985
2.1	28	382	68	938	113	1567	253	3506	440	6103	997	13836	1747	24238	3063	42328	4393	60710
2.8	30	468	75	1150	125	1921	280	4297	487	7480	1104	16959	1934	29709	3393	51929	4866	74479
3.4	33	554	81	1362	136	2276	305	5091	530	8862	1202	20092	2105	35197	3652	60182	5238	86316
4.1	36	641	88	1575	146	2632	327	5888	570	10248	1292	23235	2264	40703	3934	69839	5643	93066
4.8	38	728	93	1789	156	2989	349	6687	607	11639	1377	26388	2413	46226	4199	77710	6022	93066
5.5	40	815	99	2003	165	3348	369	7488	643	13034	1458	29551	2553	51768	4448	77710	6379	93066
6.2	42	903	104	2219	174	3707	389	8292	676	14433	1534	32725	2687	57327	4684	77710	6719	93066
6.9	44	991	109	2434	182	4068	407	9099	709	15838	1607	35908	2815	57665	4910	77710	7043	93066
8.3	48	1167	118	2868	198	4793	442	10720	769	18660	1744	42307	3055	57665	5336	77710	7653	93066
9.7	52	1345	127	3305	212	5522	474	12352	826	21500	1872	43568	3279	57665	5732	77710	8221	93066
11.0	55	1524	135	3744	226	6256	505	13995	879	24359	1993	43568	3491	57665	6079	77710	8719	93066
12.4	58	1704	143	4186	239	6995	534	15648	929	27236	2107	43568	3691	57665	6434	77710	9228	93066
13.8	61	1885	150	4632	251	7739	562	17312	977	28935	2216	43568	3882	57665	6772	77710	9713	93066
15.2	64	2068	157	5080	263	8488	588	18987	1024	28935	2321	43568	4066	57665	7097	77710	10178	93066
17.2	68	2344	168	5757	280	9621	626	21520	1090	28935	2471	43568	4328	57665	7539	77710	10813	93066
20.7	75	2809	183	6902	306	11533	686	21932	1193	28935	2705	43568	4739	57665	8266	77710	11855	93066
24.1	81	3283	198	8065	331	13477	741	21932	1290	28935	2924	43568	5123	57665	8925	77710	12801	93066
27.6	86	3764	212	9248	355	14664	794	21932	1381	28935	3132	43568	5486	57665	9566	77710	13720	93066
31.0	92	4254	226	10450	377	14664	844	21932	1468	28935	3329	43568	5831	57665	10154	77710	14571	93066
34.5	97	4751	239	11344	399	14664	891	21932	1552	28935	3518	43568	6163	57665	10745	77710	15411	93066
41.4	107	5770	263	11344	439	14664	982	21932	1710	28935	3877	43568	6792	57665	11839	77710	16981	93066

Table 8. Natural Gas Flow Rates at Selected Process Pressures (Metric)^{1,2,3,4}
(Minimum and Maximum Operating Flow Rates in NCMH)

For EMCO Flowmeter Sizing Download emcosizing program "emcosize" at www.emcoflow.com

Notes:

- At standard conditions of 60°F and 14.7 psia, SCFH: standard cubic feet per hour (0°C and 1.013 bar, NCMH: Normal cubic meters per hour).
Process temperature is 60°F (16°C).
- Maximum flow velocity is 260 ft/sec (79 m/s) or Reynolds number limit or 7,000,000 whichever is less.
- Specific Gravity of natural gas = 0.61 and 0.8% N₂.
- Minimum flow velocity is $\sqrt{\frac{50}{\rho}}$ ft/sec, where ρ = density in $\frac{\text{lb}}{\text{ft}^3}$ ($\sqrt{\frac{74}{\rho}}$ m/sec, where ρ = density in $\frac{\text{kg}}{\text{m}^3}$) or Reynolds number limit of 20,000 whichever is greater.

Dimensions and Weights

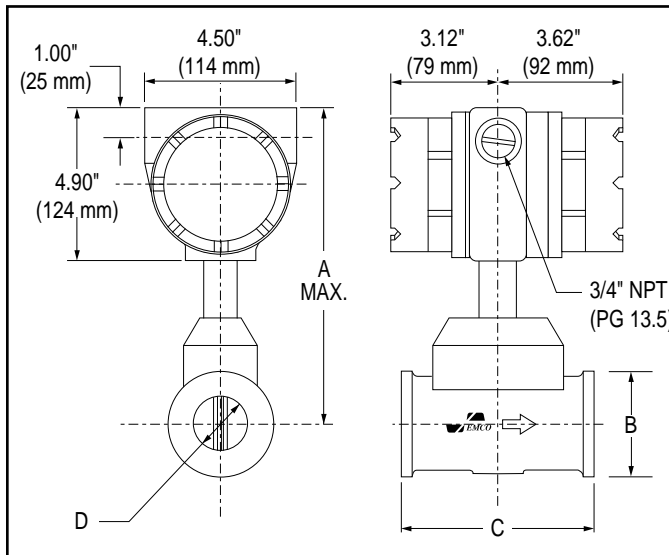


Figure 4. Dimensions and Weights:
Wafer Connection Type, Integral Mounting.

Wafer Connection

Wafer connection is available in stainless steel (sizes 1–4" only) and Hastelloy (sizes 1–3" only). The schedule of the mating pipe's internal diameter \geq dimension "D".

SIZE (in)	A (in)	B (in)	C (in)	D (in)	APPROX WT (lb)
1	10.8	2.2	4.1	0.957	13
1.5	10.5	3.1	4.1	1.500	14
2	10.8	3.6	5.0	1.939	17
3	11.5	5.0	7.0	2.900	32
4	12.2	6.2	9.5	3.826	51

Table 9. English Weights & Dimensions: Wafer

SIZE (mm)	A (mm)	B (mm)	C (mm)	D (mm)	APPROX WT (kg)
25	274	55.9	104.6	24.3	5.9
40	267	78.5	104.6	38.1	6.4
50	274	91.9	127.0	49.3	7.7
80	292	127.0	177.8	73.7	14.5
100	310	157.2	241.3	97.2	23.2

Table 10. Metric Weights & Dimensions: Wafer

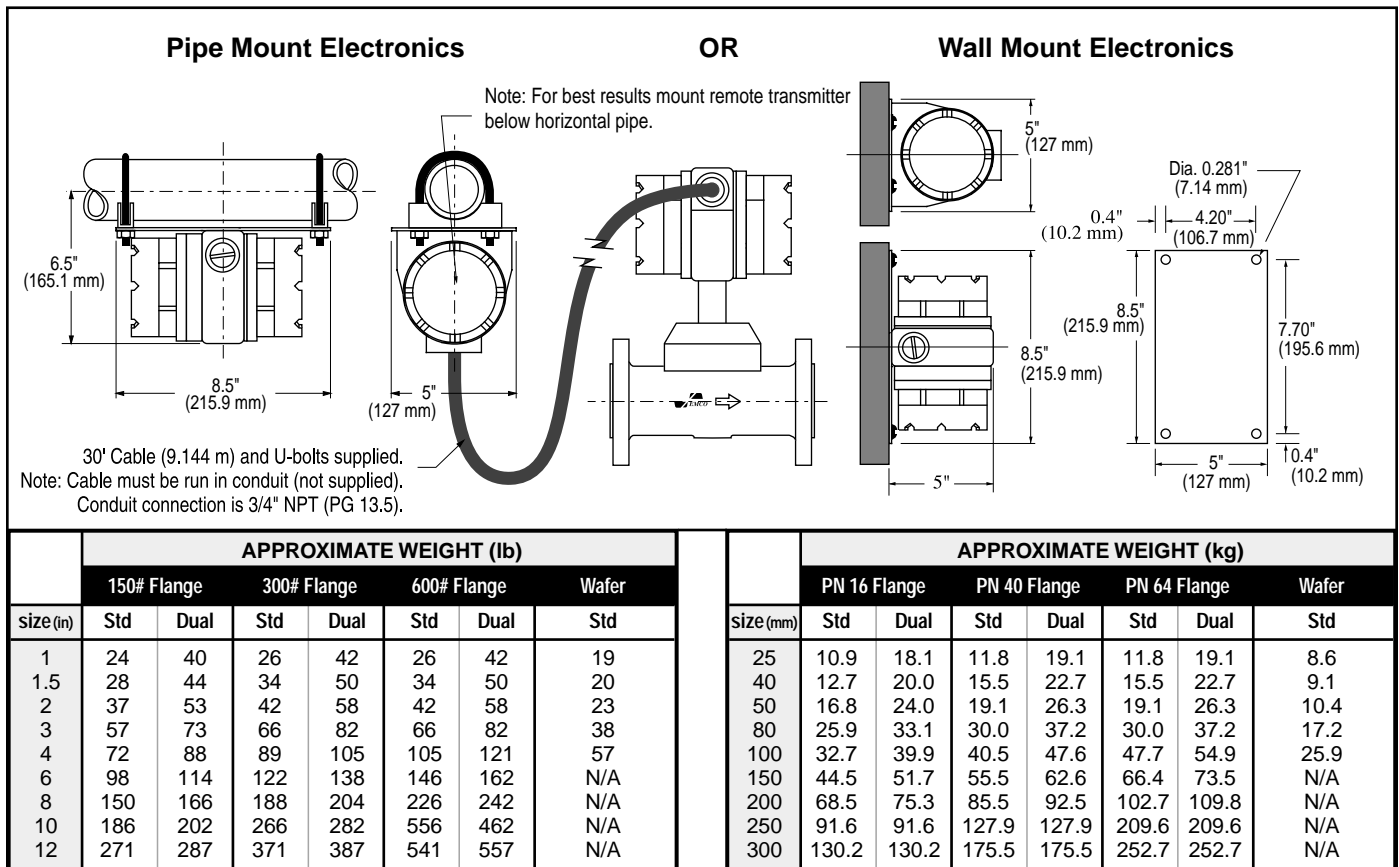


Figure 5. Dimensions and Weights: Remote Mounting.

Dimensions and Weights

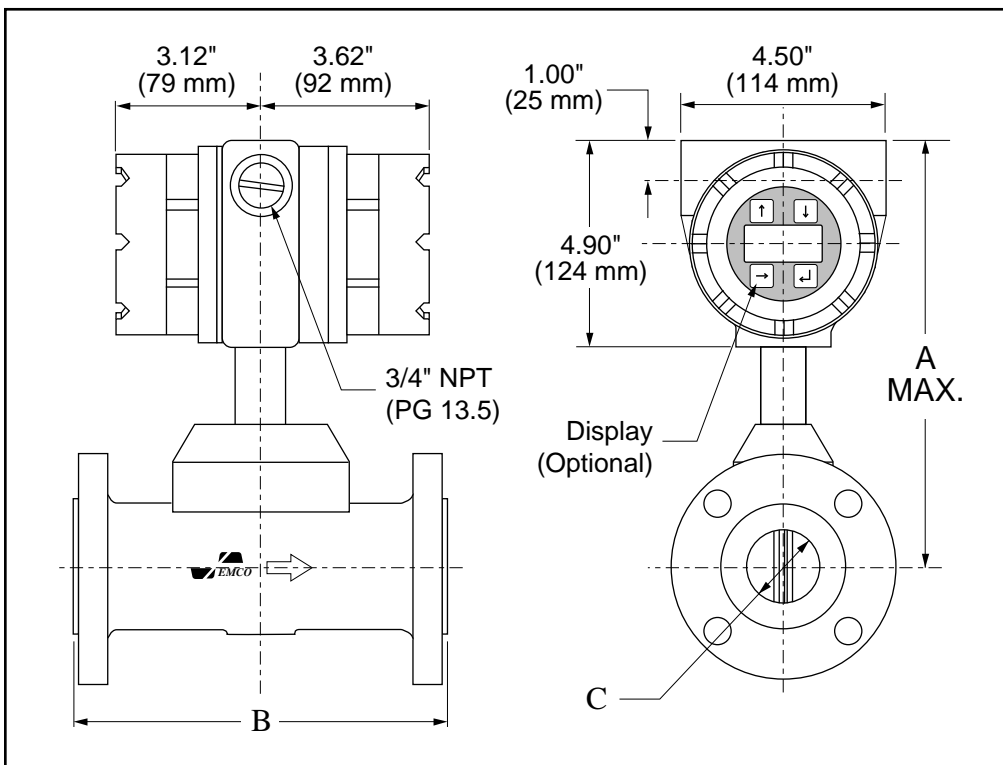


Figure 6. Dimensions & Weights: Flange Connection, Integral Mounting.

all in inches	A	B	C						Approx. Wt. (lb)			
			Stainless Steel		Carbon Steel		Hastelloy		150#	300#	600#	
			150# 300#	600#	150# 300#	600#	150# 300# 600#					
size												
1	10.7	7.6	0.957	0.957	N/A	N/A	0.957	18	20	20		
1.5	10.7	8.1	1.500	1.500	N/A	N/A	1.500	22	28	28		
2	13.2	8.5	1.939	1.939	N/A	N/A	1.939	31	36	36		
3	13.8	9.0	2.900	2.900	N/A	N/A	2.900	51	60	60		
4	14.3	9.5	3.826	3.826	N/A	N/A	3.826	55	72	99		
6	15.3	13.6	5.761	5.761	5.761	5.761	C/F	92	116	140		
8	16.3	18.5	7.625	7.625	7.625	7.625	C/F	144	182	220		
10	17.4	18.5	10.020	9.750	10.020	9.750	C/F	180	260	440		
12	18.4	18.5	12.000	11.750	11.938	11.374	C/F	265	365	535		

Table 11. English Weights & Dimensions: Flange.

all in mm	A	B	C						Approx. Wt. (kg)			
			Stainless Steel		Carbon Steel		Hastelloy		PN 16	PN 40	PN 64	
			PN 16 PN 40	PN 64	PN 16 PN 40	PN 64	PN 16 PN 40 PN 64					
size												
25	272	192.0	24.3	N/A	N/A	N/A	24.3	8.2	9.1	N/A		
40	272	206.2	38.1	N/A	N/A	N/A	38.1	10.0	12.7	N/A		
50	335	215.9	49.3	49.3	N/A	N/A	49.3	14.1	16.3	16.3		
80	350	228.6	73.7	73.7	N/A	N/A	73.7	23.1	27.2	27.2		
100	363	241.3	97.2	97.2	N/A	N/A	97.2	25.0	32.7	44.9		
150	389	346.2	146.3	146.3	146.3	146.3	C/F	41.7	53.6	63.5		
200	414	469.6	193.7	193.7	193.7	193.7	C/F	65.3	82.6	99.8		
250	442	469.9	254.4	247.7	254.5	247.7	C/FV	81.6	117.9	199.6		
300	467	469.9	304.8	298.5	303.2	288.9	C/F	120.2	165.6	242.7		

Table 12. Metric Weights & Dimensions: Flange.

Notes:

- 1 The schedule of the mating pipe's internal diameter \geq dimension 'C'.
- 2 N/A = Not Available, C/F = Consult Factory.

Dimensions and Weights

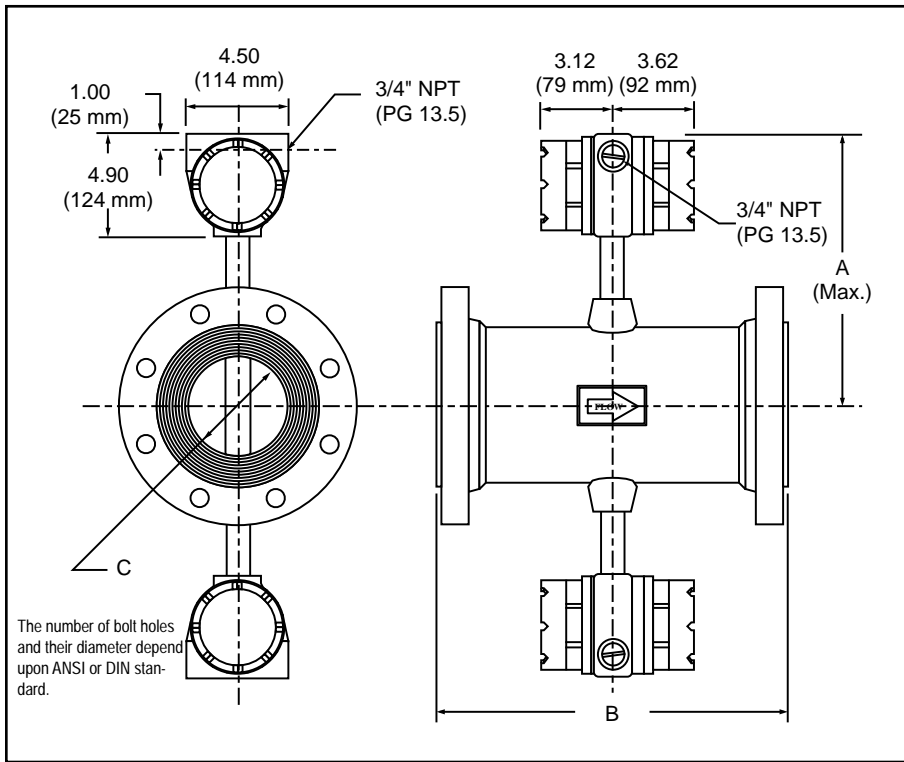


Figure 7. Dimensions & Weights: Dual Style.

all in inches	A	B			C		C		C			Approx. Wt. (lb)
		150#	300#	600#	Stainless Steel		Carbon Steel		Hastelloy			
size					150# 300#	600#	150# 300#	600#	150# 300# 600#	150#	300#	600#
1	13.8	8.4	8.9	9.4	0.957	0.957	N/A	N/A	0.957	28	30	30
1.5	14.0	8.9	9.4	10.0	1.500	1.500	N/A	N/A	1.500	32	38	38
2	14.2	9.0	9.5	10.3	1.939	1.939	N/A	N/A	1.939	35	46	46
3	13.8	9.0	9.0	9.0	2.900	2.900	N/A	N/A	2.900	61	70	70
4	14.3	9.5	9.5	9.5	3.826	3.826	N/A	N/A	3.826	76	93	109
6	15.3	13.6	13.6	13.6	5.761	5.761	5.761	5.761	C/F	102	126	150
8	16.3	18.5	18.5	18.5	7.625	7.625	7.625	7.625	C/F	154	192	230
10	17.4	18.5	18.5	18.5	10.020	9.750	10.020	9.750	C/F	190	270	450
12	18.4	18.4	18.5	18.5	12.000	11.750	11.938	11.374	C/F	275	375	545

Table 13. English Weights & Dimensions: Dual.

all in mm	A	B			C		C		C			Approx. Wt. (kg)
		PN 16	PN 40	PN 64	Stainless Steel		Carbon Steel		Hastelloy			
size					PN 16 PN 40	PN 64	PN 16 PN 40	PN 64	PN 16 PN 40 PN 64	PN 16	PN 40	PN 64
25	351	212.9	225.6	238.3	24.3	24.3	N/A	N/A	24.3	8.2	9.1	9.1
40	356	225.6	238.8	254.0	38.1	38.1	N/A	N/A	38.1	10.0	12.7	12.7
50	361	228.6	241.3	260.4	49.3	49.3	N/A	N/A	49.3	15.9	16.3	16.3
80	350	228.6	228.6	228.6	73.7	73.7	N/A	N/A	73.7	23.1	27.2	27.2
100	369	241.3	241.3	241.3	97.2	97.2	N/A	N/A	97.2	29.9	37.6	44.9
150	388	346.2	346.2	346.2	146.3	146.3	146.6	146.3	C/F	41.7	52.6	63.5
200	413	469.9	469.9	469.9	193.7	193.7	193.7	193.7	C/F	65.3	82.6	99.8
250	445	469.9	469.9	469.9	254.4	247.7	254.5	247.7	C/F	81.6	117.9	199.6
300	470	469.9	469.9	469.9	304.8	298.5	303.2	288.9	C/F	120.2	165.6	242.7

Table 14. Metric Weights & Dimensions: Dual.

Notes:

- 1 The schedule of the mating pipe's internal diameter \geq dimension 'C'.
- 2 N/A = Not Available, C/F = Consult Factory.

Wiring

Figures 8–10 represent typical field wiring applications for the Vortex PhD.

Analog Output

The Vortex PhD may be operated using a 24 VDC power supply. The 4-20 mA output is scalable (2 wire principle.) The load resistor may be installed on supply or return line. Permissible load resistance values are shown in Figure 8.

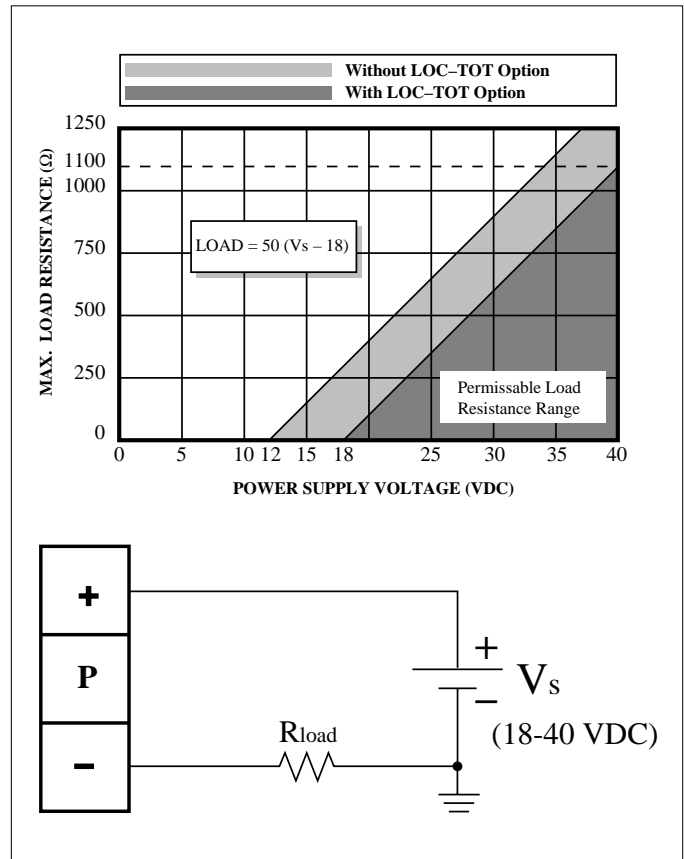


Figure 8. 4-20 mA Output.

Pulse Output

This is an open collector pulse output using a high impedance electronic counter. V_{pulse} will vary from:

$$0 - 1V \text{ to } V_{pulse} = V_s \left(\frac{R_c}{R_c + R_{pulse}} \right)$$

Note: $R_{pulse} \geq \left(\frac{V_s}{0.16} \right)$

Where:

- V_{pulse} = pulse output amplitude
- R_c = counter impedance
- V_s = power supply voltage
- V_c = minimum required voltage to trip counter

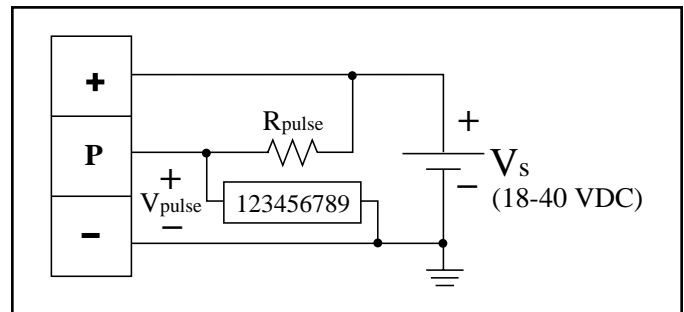


Figure 9. Pulse Output.

Wiring

Cenelec Approved–Power & Signal Wiring

The Vortex PhD flowmeter may be operated using a 24 VDC power supply. The wiring schematic shown is for the areas defined by the Cenelec approval (see approval description in options section). I. S. zener barriers must have the following specifications:

- $V_{max} = 29 \text{ VDC}$ = Maximum voltage which may be connected to barrier terminals
- $J_{max} = 110 \text{ mA}$ = Maximum current which may be connected to barrier terminals
- $C_{int} = 1.5 \text{ nF}$ = Maximum equivalent internal capacitance across barrier terminals
- $L_{int} = 0 \text{ H}$ = Maximum equivalent internal inductance across barrier terminals

The 4-20 mA output is scalable (2 wire principle.) The 4-20 mA loop resistor should be 250 Ω ; and the pulse output is to be connected to a high impedance, electronic counter.

$$V_{pulse} \text{ varies from: } 0 - 1 \text{ VDC to } V_{pulse} = V_s \left(\frac{R_c}{R_c + R_{pulse}} \right)$$

Note: $R_{pulse} \geq \frac{V_s}{0.16}$

Where:

- V_{pulse} = Pulse output amplitude
- V_s = Power supply voltage (18 to 29 VDC)
- R_{load} = Load resistance
- R_c = Counter impedance
- R_{pulse} = Pull-up resistance

110/220 VAC–Power & Signal Wiring

The Vortex PhD flowmeter may be operated using a 110/220 VAC power supply. The power supply board converts the 110/220 VAC to 24 VDC. The 4-20 mA output is scalable (2 wire principle.) The 4 - 20 mA loop resistor should be 250 Ω ; and the pulse output is to be connected to a high impedance, electronic counter. (Figure 11)

$$V_{pulse} \text{ varies from } 0-1 \text{ VDC to } V_{pulse} = 24 \text{ VDC} - (I \cdot R_{load})$$

Where:

- V_{pulse} = Pulse output amplitude
- R_{load} = Load resistance (250 Ω)
- I = Current (4 - 20 mA)

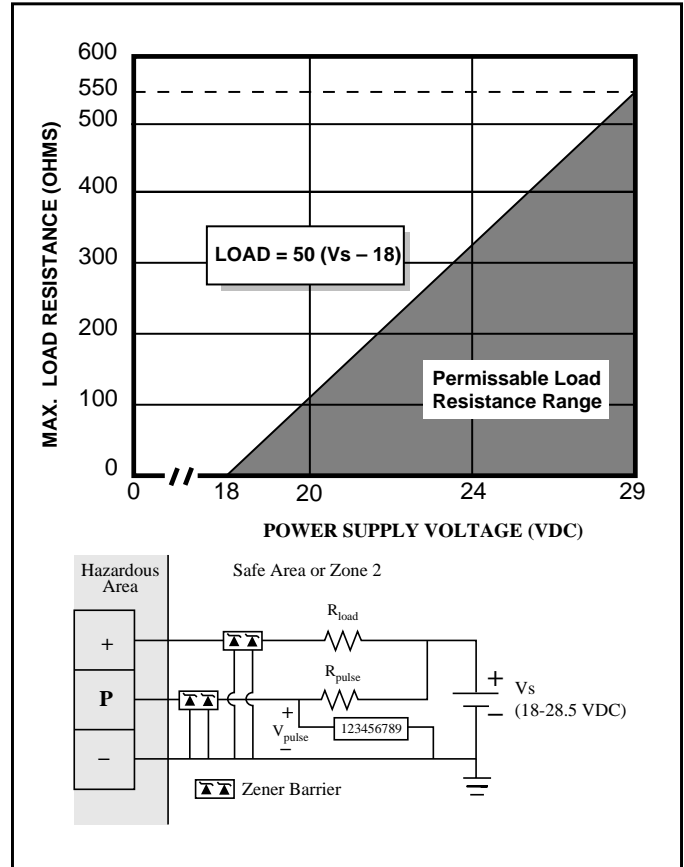


Figure 10. CENELEC Approved (Intrinsically Safe).

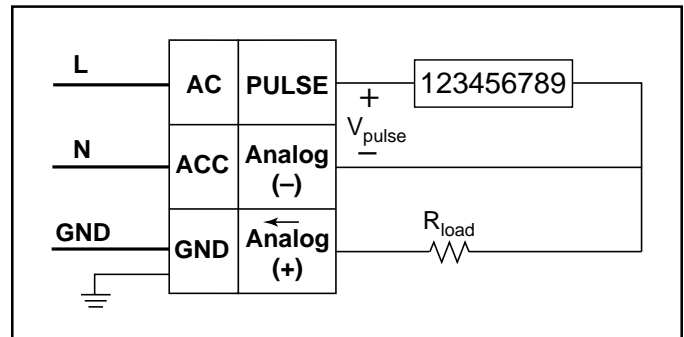


Figure 11. Frequency/4-20 mA Output Using 110/220 VAC Power.

Customer Name

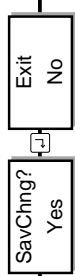
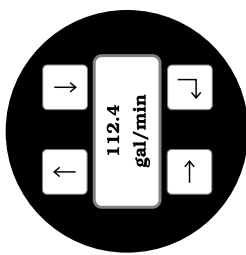
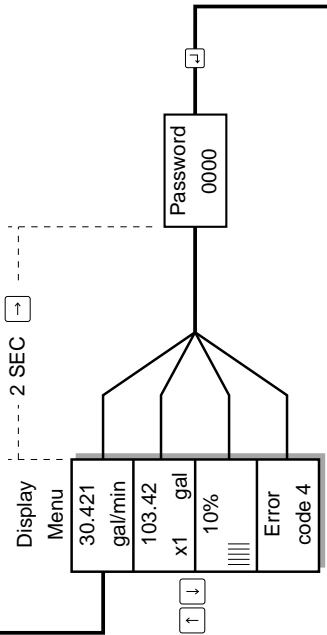
FLUID:

To Move Through Map

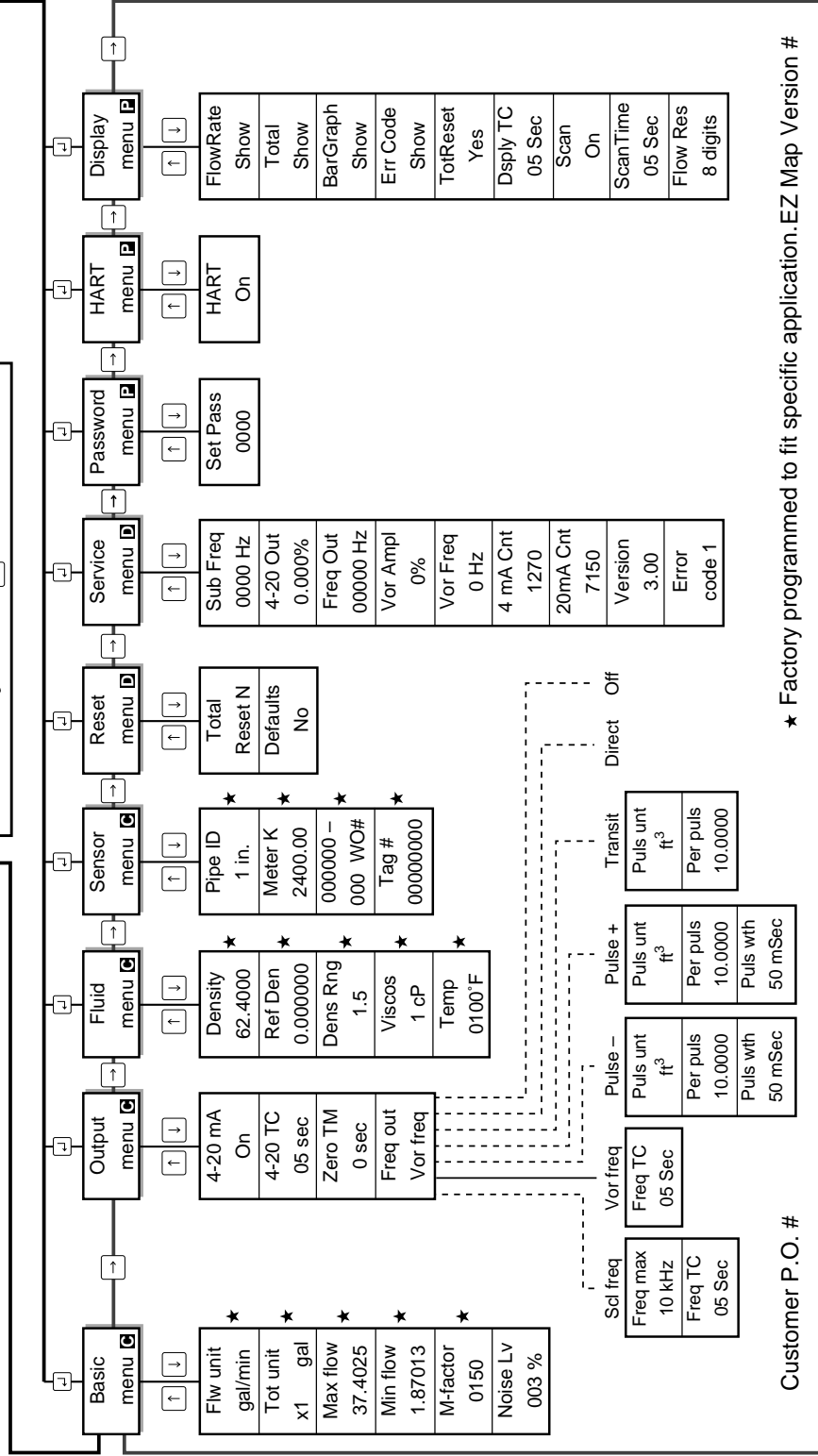
1. Use up/down \uparrow \downarrow and right \rightarrow arrows as shown in map
2. While in display menu hold down right \rightarrow arrow key for 2 sec. to go to programming menus
3. While in column headings press ENTER \downarrow key to go to display menu. You will be prompted by "Exit?" and then "Sav Chg?".

To alter data

1. To alter data press ENTER \downarrow key within selected block
2. Use up/down arrows \uparrow \downarrow to alter value
3. Use right arrow \rightarrow to move cursor position
4. To store data press ENTER \downarrow



Work Order



★ Factory programmed to fit specific application. EZ Map Version #

Customer P.O. #

Model and Suffix Codes

CATEGORY	DESCRIPTION	SUFFIX CODES					
<i>Model</i>	Stainless Steel (sizes 1–12") Hastelloy (sizes 1–8") Carbon Steel (Stainless steel wing) (sizes 6–12")	PhD-90	...	...	...	...	...
		PhD-91	...	...	...	...	...
		PhD-92	...	...	...	...	...
<i>Fluid Type</i>	Steam or gas Liquid	...	S	...	...	...	...
		...	L	...	...	...	...
<i>Line Size</i>	1" 1.5" 2" 3" 4" 6" 8" 10" 12" 25 mm 40 mm 50 mm 80 mm 100 mm 150 mm 200 mm 250 mm 300 mm	...	...	10	...	...	...
		...	...	15	...	...	...
		...	...	20	...	...	...
		...	...	30	...	...	...
		...	...	40	...	...	...
		...	...	60	...	...	...
		...	...	80	...	...	...
		...	...	100	...	...	...
		...	...	120	...	...	...
		...	...	DN25	...	...	...
		...	...	DN40	...	...	...
		...	...	DN50	...	...	...
		...	...	DN80	...	...	...
		...	...	DN100	...	...	...
		...	...	DN150	...	...	...
		...	...	DN200	...	...	...
		...	...	DN250	...	...	...
		...	...	DN300	...	...	...
<i>Connection Type</i>	Wafer ⁶ Flange	...	...	...	W	...	...
		...	...	...	F	...	...
<i>Connection Rating</i>	ANSI Class 150 ANSI Class 300 ANSI Class 600 DIN, PN 16 DIN, PN 40 DIN, PN 64	...	...	...	...	150	...
		...	...	...	...	300	...
		...	...	...	...	600	...
		...	...	...	...	PN 16	...
		...	...	...	...	PN 40	...
		...	...	...	...	PN 64	...
<i>Options</i>	No indicator/totalizer option ¹ FM approved ² CSA approved CENELEC approved ² Local Indicator and Totalizer ³ Remote Mount Electronics ⁴ Integral 110 VAC input ⁵ Integral 220 VAC input ⁵ Dual sensor and transmitter ⁷	...	...	...	...	...	STD
		...	...	...	...	...	FM
		...	...	...	...	...	CSA
		...	...	...	...	...	CEN
		...	...	...	...	...	LOC-TOT
		...	...	...	...	...	RMT
		...	...	...	...	...	110
		...	...	...	...	...	220
		...	...	...	...	...	DUAL
<i>Sensor Wires (Internal)</i>	Teflon, –40° to 400°F (–40° to 204°C) Fiberglass, 150° to 750°F (65° to 400°C)	...	...	...	...	...	T
		...	...	...	...	...	F

Example

↳ PhD-90-S-60-F-300-LOC-TOT-RMT-T

Table 15. PhD Vortex Shedding Flowmeter.

Notes:

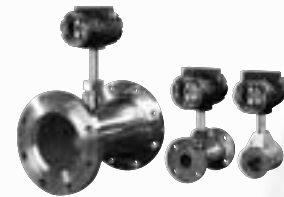
- Has 4-20 mA and/or 50% duty cycle frequency output. A 50% duty cycle frequency can be scaled.
- FM and CENELEC approved meters come with a magnet wand. For all other meters the wand can be ordered as an option.
- At least one local indicator is recommended at each site. If one display will be used on many meters, should be purchased separately.
- Remote mount electronics are required for high process temperatures (refer to the general specification). The standard remote mount option comes with 30' of cable.
- Not available with European CE Mark or FM, CSA and CENELEC approvals.
- Wafer style meters available in stainless steel (sizes 1–4" only) and Hastelloy (sizes 1–3" only). (Not available with dual option).
- Dual flowmeter is *not* available with wafer connections or CSA approval.

	STD	FM	CSA	CENELEC	LOC-TOT	RMT	110/220	DUAL	CARBON STEEL	HASTELLOY	STAINLESS STEEL	EUROPEAN CE MARK
STD	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
FM	Incompatible	Compatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
CSA	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
CENELEC	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
LOC-TOT	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
RMT	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
110/220	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
DUAL	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible	Incompatible
CARBON STEEL	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible	Incompatible
HASTELLOY	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible	Incompatible
STAINLESS STEEL	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible	Incompatible
EUROPEAN CE MARK	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Compatible

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- ▶ Manufacturing is housed in a modern plant located in Longmont, Colorado
- ▶ Modern clean-room, mechanized assembly equipment, and computer based testing ensure the highest quality product
- ▶ Trained professional flow specialists and technicians offer timely customer assistance
- ▶ Factory trained and certified field technicians provide product support services



Vortex PhD™ Inline Vortex



V-Bar™
Insertion
Vortex



Turbo-Bar™
Insertion
Turbine



MAGFLO® Electromagnetic



PDH Helix



PDP Piston



Sono-Trak™



P/N 990100 Rev.K

Specifications subject to change without notice

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